ADT PLM

Programmer's Learning Machine

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Outline

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Presentation of PLM

Purposes

- Application to learn programming.

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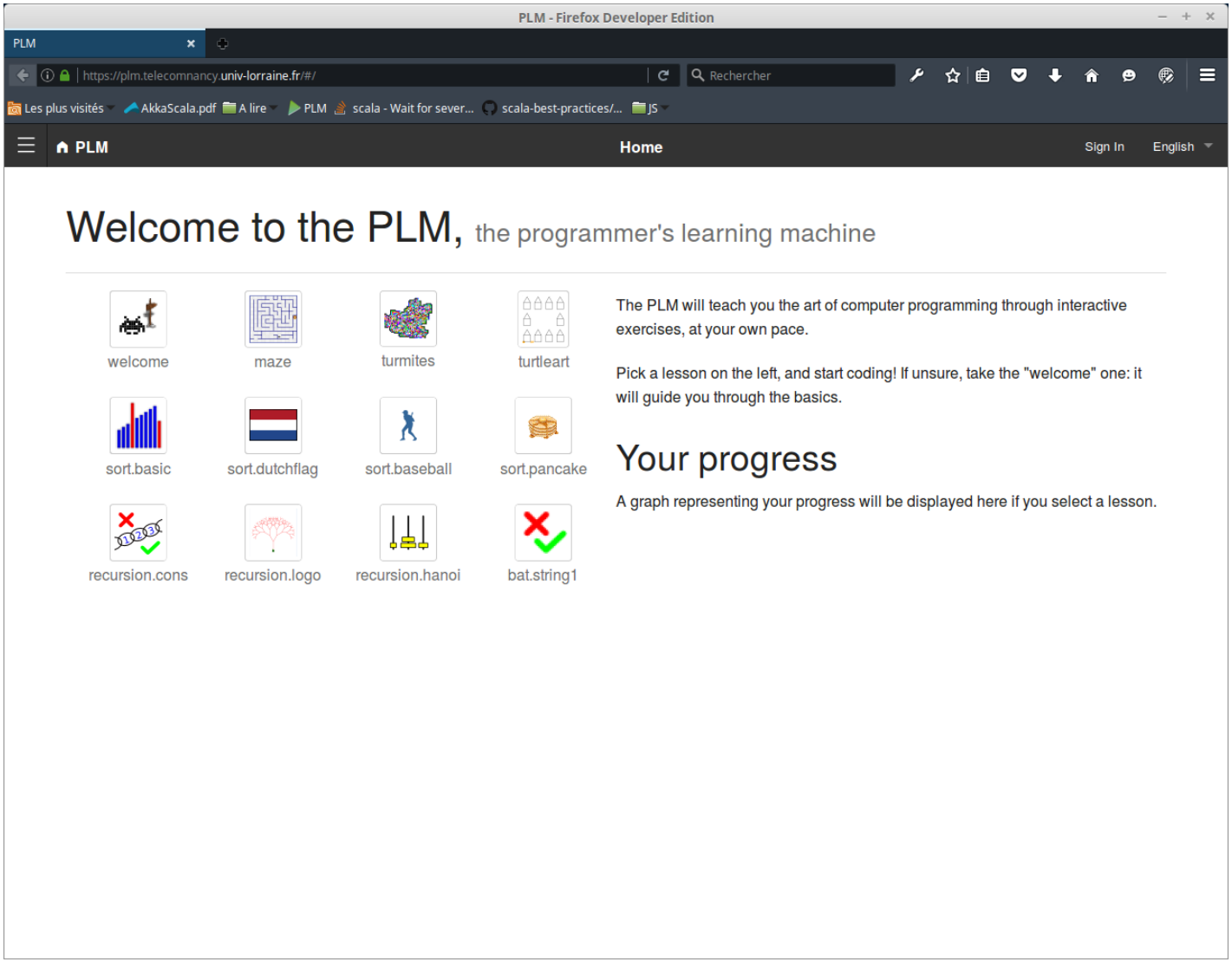
- Application to learn programming.
- Allows students to progress at their own speed...
- ... while the teacher helps the ones having trouble.
- Used at TELECOM Nancy since 2008.

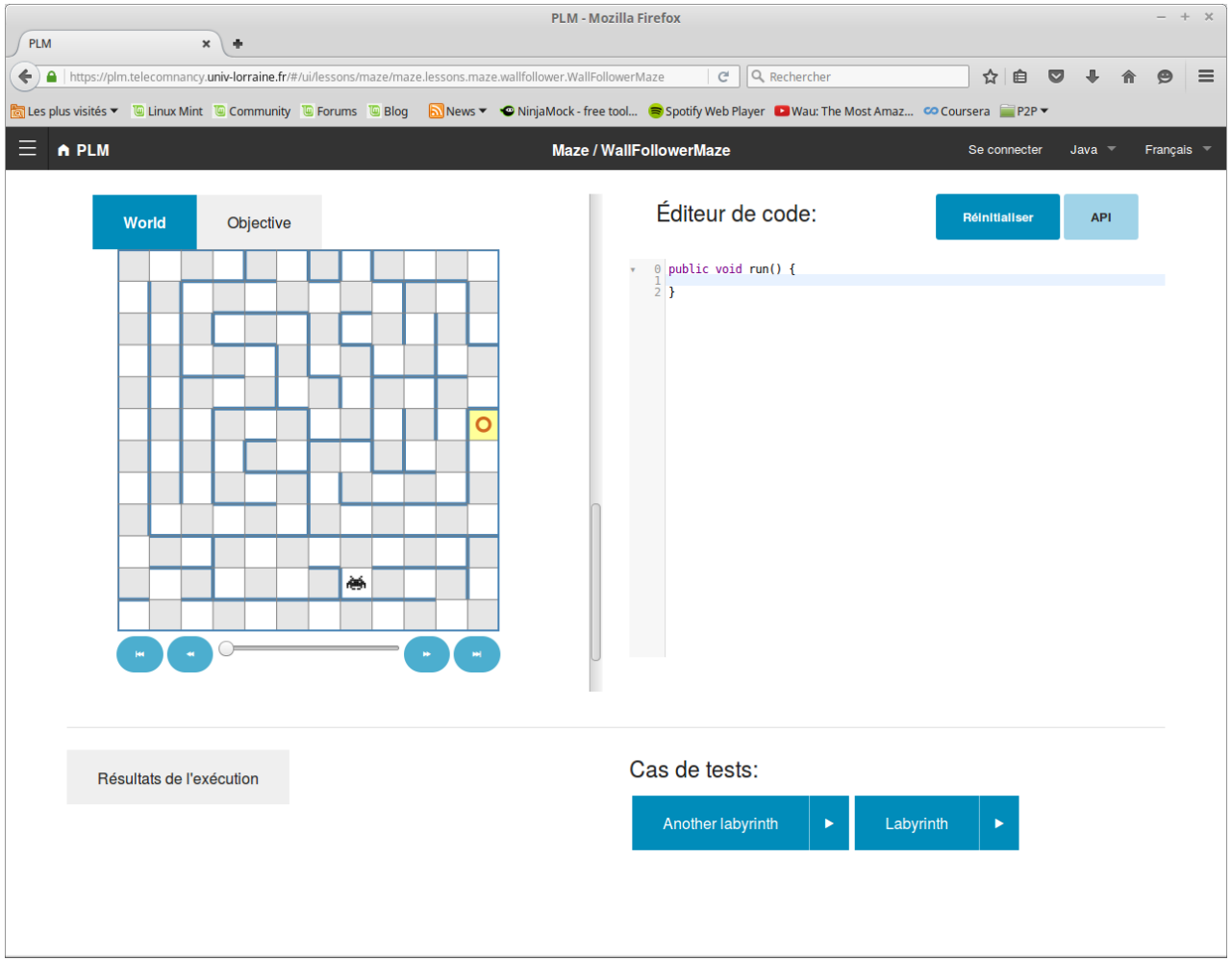
Presentation of PLM

Quick demo



Presentation of PLM

12 lessons, 200 exercises



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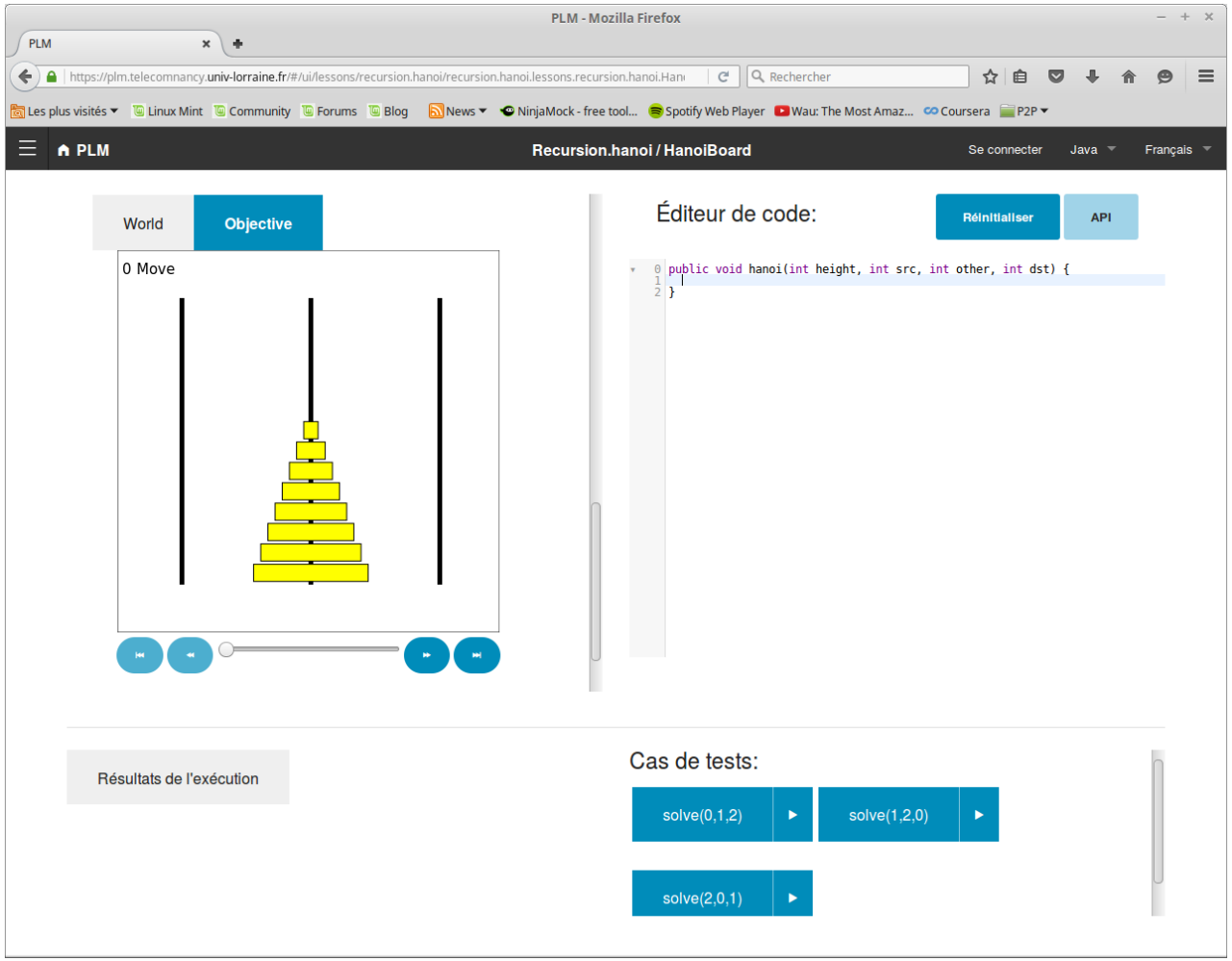

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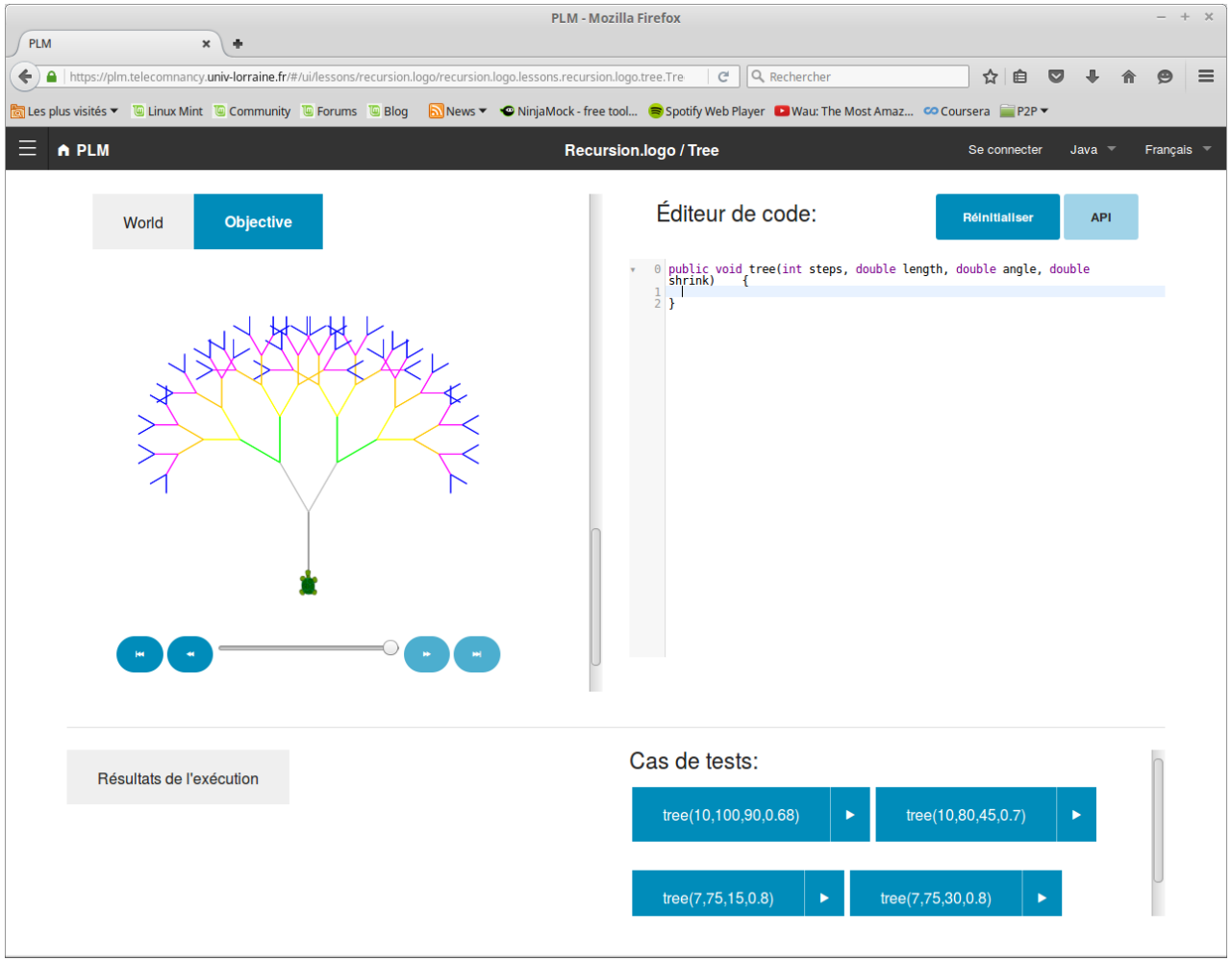

- Available languages:
  - English
  - French
  - Brazilian Portuguese

- Supported programming languages:

Presentation of PLM

Evolution of the project

- Formerly a fat client
  - Written in Java

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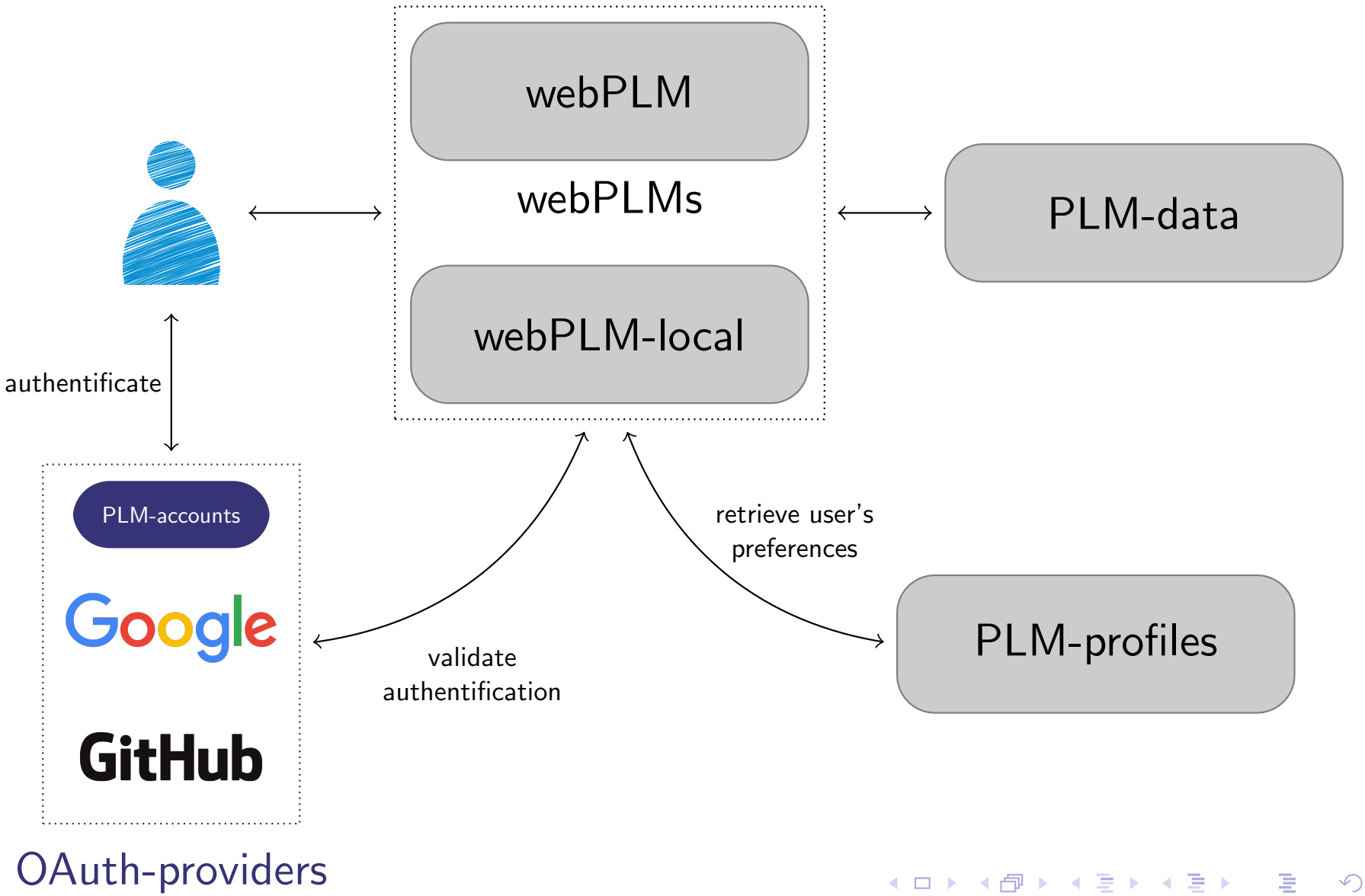
  - Written in Java
- Switch to a web application
  - Headless version of PLM
  - Server implemented in Scala using *PlayFramework*
  - User interface written in Javascript using *AngularJS* and *Foundation*

Presentation of PLM

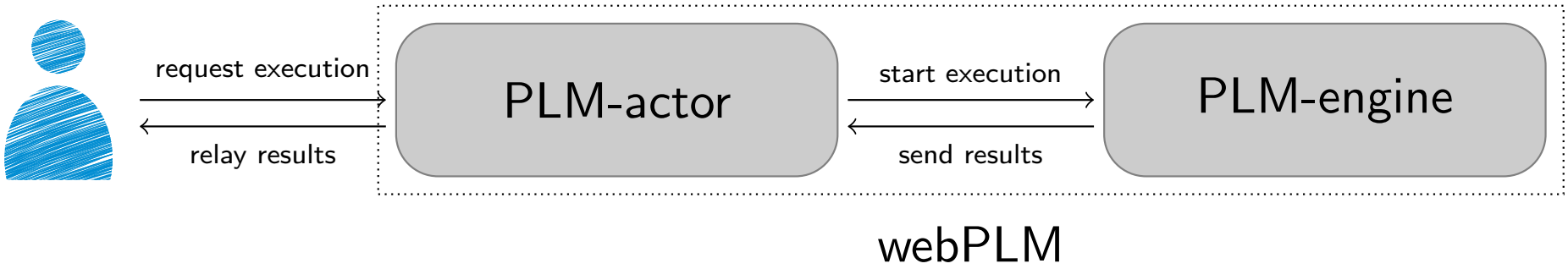
Application's architecture



Outline

Assessment of user's code

Execution components



Assessment of user's code

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- Run on the same machine, same JVM

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- And from more malicious "mistakes"?
  - Infinite thread creation
  - Endless file creation

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- And from *System.exit(whatever)*?

Assessment of user's code

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- How to protect ourselves from users' rookie mistakes?
  - Infinite loops
- And from more malicious "mistakes"?
  - Infinite thread creation
  - Endless file creation
- And from *System.exit(whatever)*?
- Scalability issues

Assessment of user's code

Chosen solution

- Delegate the execution to workers
  - Called *Judges* in the litterature
  - Use headless version of PLM as well
  - Execute user's code and send back result to webPLM

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  - Prevent obvious issues with a security manager
  - Handle timeout and crash

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  - Execute user's code and send back result to webPLM
- *Let it crash* strategy
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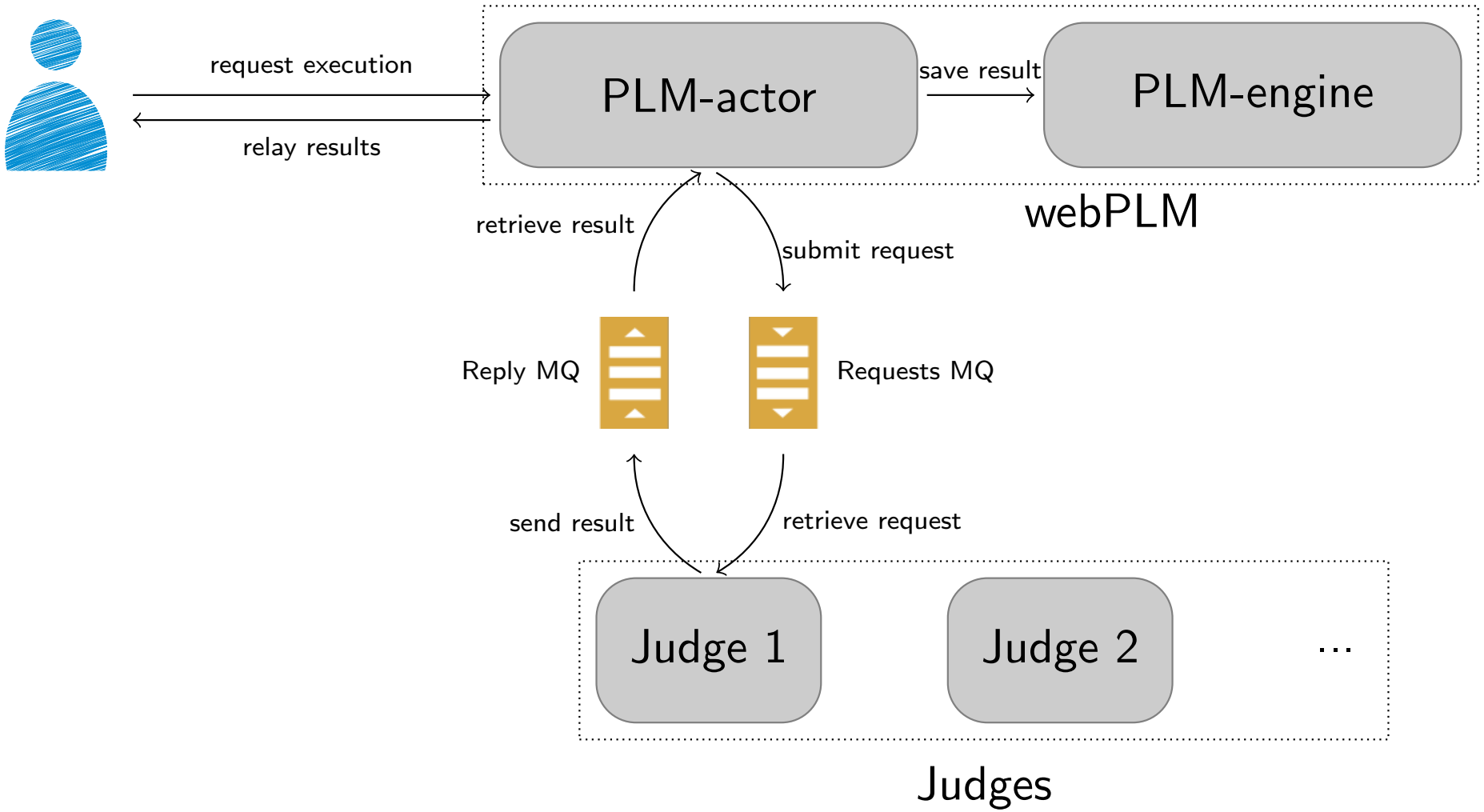
  - Handle timeout and crash
- Distribute workload using message queues
  - One queue for requests
  - One queue per result

Assessment of user's code

Architecture with judges



Assessment of user's code

Pros and cons

- Pros:
  - Allow to run code without impacting webPLM's performances
  - Meet the scalability requirements

Assessment of user's code

Pros and cons

- Pros:
  - Allow to run code without impacting webPLM's performances
  - Meet the scalability requirements
- Cons:
  - Make sure to use the right version of PLM
  - Need to deploy them easily
  - Should restart them after each execution
  - Have to restrict their resources usage

Assessment of user's code

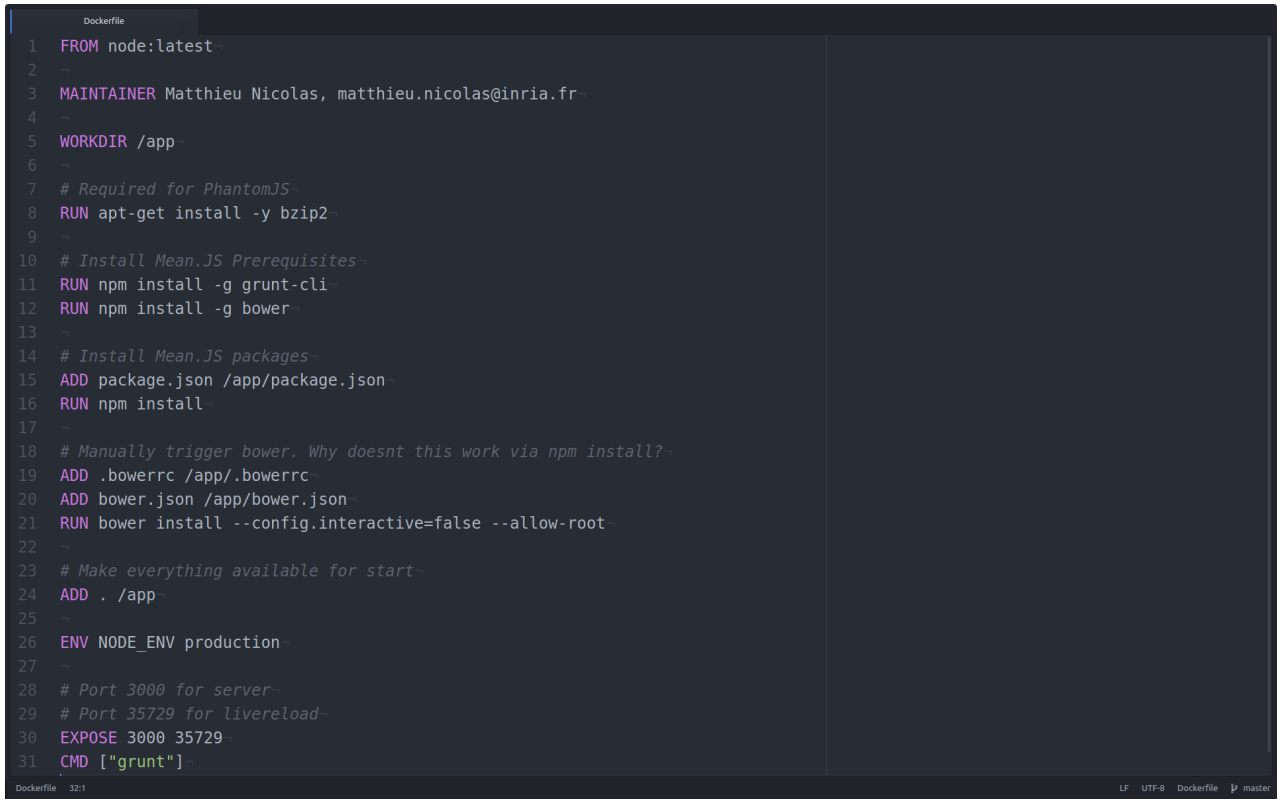
Docker

- Lightweight virtualization tool
- Build image of your application
- Run containers based on images

Assessment of user's code

Example of Dockerfile

- Dockerfiles describe how to set up the application



- Run *docker build -t tag /path/to/Dockerfile* to build the image
- Start containers with *docker run tag*

Assessment of user's code

More about *docker run*

- Can also manage
  - Ports

Assessment of user's code

More about *docker run*

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  - Ports
  - Volumes

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More about *docker run*

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  - Volumes
  - Links between containers

Assessment of user's code

More about *docker run*

- Can also manage
  - Ports
  - Volumes
  - Links between containers
  - Environment variables
  - Runtime constraints on resources
  - Restart policies
  - And a **lot more**

Assessment of user's code

More about *docker run*

- Can also manage
  - Ports
  - Volumes
  - Links between containers
  - Environment variables
  - Runtime constraints on resources
  - Restart policies
  - And a **lot more**

- Commands can become quite complex

docker run -p 443:9443 -link plm-accounts:accounts -v ~/webPLM/logs/:/app/webplm-dist/logs webPLM

Assessment of user's code

Docker-compose

- Tool to easily deploy multi-containers applications

```yaml
nginx:
  image: nginx
  ports:
    - "80:80"

messagequeue:
  image: rabbitmq:3-management
  ports:
    - "5672:5672"
    - "15672:15672"

plm:
  image: webplm
  volumes:
    - "~/.plm:/root/.plm"
    - "~/webPLM/logs/:/app/webplm-dist/logs"
  ports:
    - "443:9443"
  environment:
    GITHUB_CLIENT_SECRET:
    GOOGLE_CLIENT_SECRET:
    PLMACCOUNTS_CLIENT_SECRET:
    GITHUB_ACCESS_TOKEN:
  links:
    - accounts
    - profiles
    - messagequeue:messageq

accounts:
  image: plm-accounts
  environment:
    GITHUB_CLIENT_SECRET:
    GOOGLE_CLIENT_SECRET:
    PLMACCOUNTS_CLIENT_SECRET:
    GITHUB_ACCESS_TOKEN:
  links:
    - accounts
    - profiles
    - messagequeue:messageq

profiles:
  image: plm-profiles
  ports:
    - "8080:3000"
  links:
    - db

db:
  image: mongo
  volumes:
    - "~/mongodb/data:/data/db"
  ports:
    - "27017:27017"
```

- Deploy environment with *docker-compose up*

Assessment of user's code

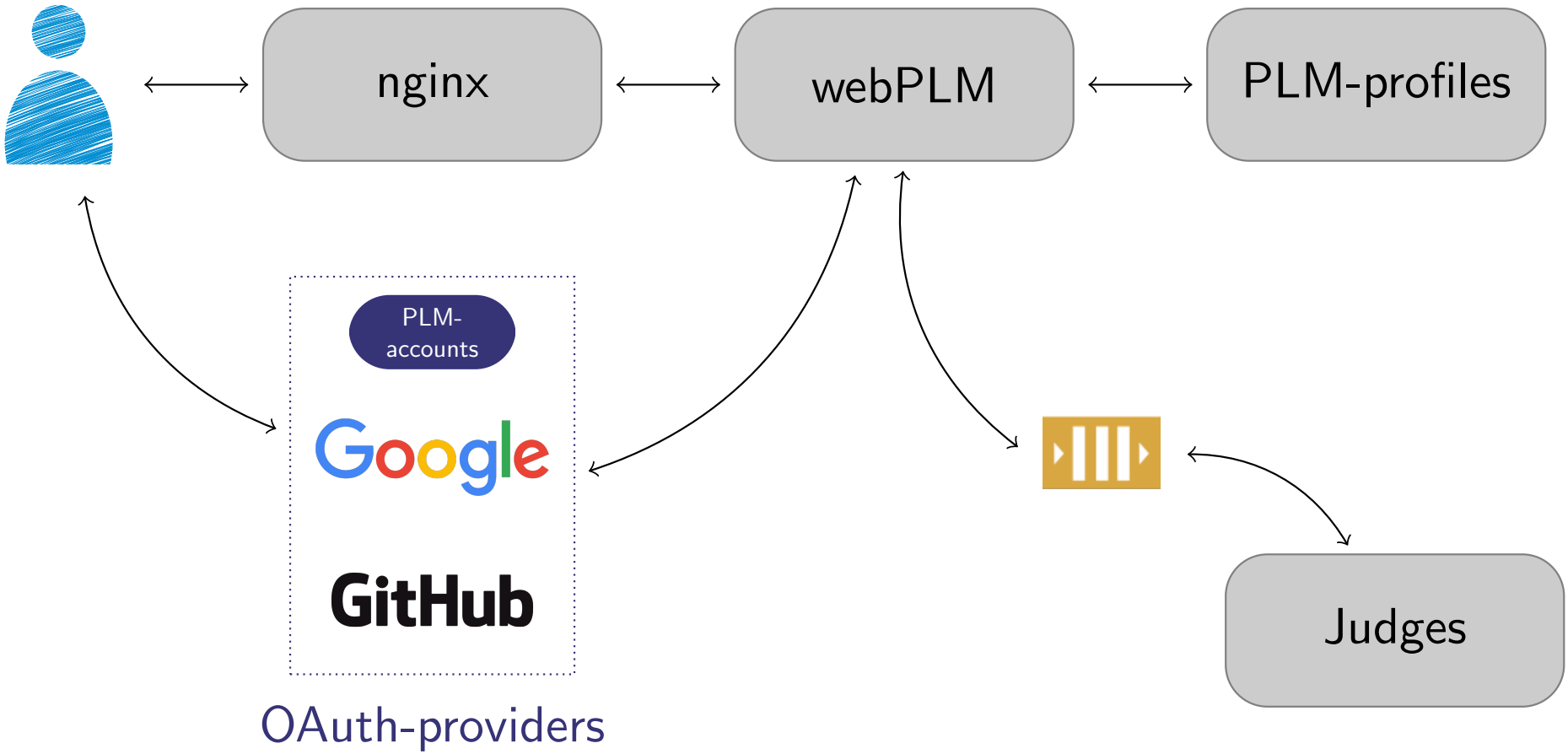
Docker in our case

- Deploy easily all components
- Restart judges automatically
- Limit users' mischiefs

Outline

Result

Current architecture



Result

Live-session in TELECOM Nancy

- Used in TELECOM Nancy in September 2015
- 30 hours of live testing with 100 students.

Result

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- Used in TELECOM Nancy in September 2015
- 30 hours of live testing with 100 students.

- Engine is (almost) working fine...
- ... but user experience needs to be improved!

Result

Live-session in TELECOM Nancy

- Can't cope with the workload.

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Live-session in TELECOM Nancy

- Can't cope with the workload.
- No tools for monitoring set up...

Result

Live-session in TELECOM Nancy

- Can't cope with the workload.
- No tools for monitoring set up...
- ... so the bottleneck is unknown.

Outline

Next steps

Refactor the code

- Rushed to release a stable version before September 2015...
- Needed to clean some parts of the code.
- Standardized behavior of local and server mode.

Next steps

Simplify workflow to adapt the content

- Store most of content inside PLM.
- Heavy and error prone workflow.
- Need to extract the content from PLM's jar.
- Allow to implement an exercise editor.

Next steps

Solve performance issues

- Set up some monitoring tools.
- Perform some load testing to identify the bottleneck.

Questions

Thanks for your attention, any questions?